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PREPARING POTTING MEDIUMS AND COMPOSTS

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PESTICIDES PRECAUTION

Pesticides used improperly can be injurious to man, domestic animals, beneficial insects, plants, fish, and wildlife. Follow the directions and need all precautions on the labels.

Store pesticides in original containers--out of reach of children and pets--and away from foodstuff.

Apply pesticides selectively and carefully. Do not apply a pesticide when there is danger of drift to other areas. Avoid prolonged inhalation of a pesticide spray or dust. When applying a pesticide it is advisable that you be fully clothed.

After handling a pesticide, do not eat, drink or smoke until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If the pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Dispose of empty pesticide containers by wrapping them in several layers of newspaper and placing them in your trash can.

It is difficult to remove all traces of a herbicide (weed killer) from equipment. Therefore, to prevent injury to desirable plants do not use the same equipment for insecticides and fungicides that you use for a herbicide.

NOTE: Registrations of pesticides are under constant review by the Federal Environmental Protection Agency. Use only pesticides that carry an official State or Federal registration number as well as directions for home and garden use.

PREPARING POTTING MEDIUMS AND COMPOSTS

By R. S. Dyal, Soil Scientist

PLANT GROWING MEDIUMS

The essential requirements of a good potting or seedbed medium are that it have good physical properties, be free from harmful organisms and toxic substances, and provide an adequate and balanced supply of available plant nutrients. The medium should be consistent and reliable, thus reducing risk of failure. It should also be composed of materials that are easy to get, reasonably priced, of fairly uniform quality, and easily mixed or blended.

For plants grown in containers, the physical properties of the potting medium largely determine its success. A medium that is too sandy dries too quickly, whereas one of clay becomes wet and sticky after watering and dries hard and cracks. The medium must possess a crumbly structure that permits entry of air; it must be able to hold sufficient moisture and still permit excess moisture to drain freely. The flow and storage of moisture, air movement, and nutrient availability to plants are examples of properties that are determined by the size and arrangement of soil particles.

Topsoil from a fertile field may make an ideal base for potting soil. Close attention should be paid to the physical character of the soil. A loam is preferable. The fact that the soil is black does not always indicate that it contains adequate organic matter or is fertile. Because topsoils may contain harmful organisms such as nematodes, wireworms, disease pathogens, and weed seeds, they should be sterilized by steam, dry heat, or chemicals.

The soil should hold an adequate and balanced supply of plant nutrients, to provide satisfactory growth during the early stages of plant growth. Additional fertilization is usually required for later growth. If sufficient soluble plant nutrients to meet the plants needs to maturity are added during the preparation of the potting medium, excess salinity usually occurs.

To prevent crop injury by excess salinity in potting soils prepared by composting soil and manure, mix the soil and manure and shape the top of the pile to catch and hold water until the water can infiltrate into the pile and thereby leach the excess salts from the pile.

The difficulties mentioned above with soil and manure potting mediums, the lack of uniformity of raw materials, and the ease of procurement of other materials led to the testing and recommendation of potting mediums of other materials.

Scientists of the University of California, Los Angeles, undertook studies to find a better growing medium for plants grown in containers. These mixes designated as the "U. C.-type soil mixes," are given in table 1.

A desirable sand for purposes of the mix has a particle size range from very fine sand to medium sand. Coarse sand should not exceed 12 to 15 percent, preferably less; fine sand should not be less than 70 percent and preferably 85 percent or higher; and slit plus clay should not exceed 15 percent, preferably lower. Six fertilizers are given in the California report for each of the five "U. C. type soil mixes." One fertilizer for each is given in table 2.

The New York State College of Agriculture suggests the use of artificial soils for plants grown in containers, because good topsoil is increasingly difficult to find and weed seeds and disease organisms in the soil make sterilization necessary. (See table 3.)

TABLE 1.--The five basic University of California-type soil mixes

Soil mix	Ingredients				Maximum water content [1]		pH with fertilizer added	Comments and suggested uses
	By volume		Weight per cubic foot					
	Fine sand	Peat moss	At maximum water content	Oven dry	By volume	By weight		
	Pct.	Pct.	Lb.	Lb.	Pct.	Pct.		
A----	100	0	117	89	43	30	7.0	Seldom used; densest and least retentive of nutrients; for tin cans, flats, beds.
B----	75	25	105	76	46	38	6.8	Commonly used; good physical properties; for tin cans, flats, beds.
C----	50	50	94	63	48	48	6.5	Commonly used; excellent physical properties; for clay pots and beds.
D----	25	75	66	34	51	94	6.0	Lightweight; excellent aeration; for clay pots and beds.
E----	0	[2]100	43	7	59	530	5.7	Very lightweight; used for azaleas; sometimes gardenias and camellias.

[1] Maximum water content and weight at that moisture level are typical for a 6-inch column of a mixture of fine sand of the Oakley series and Canadian peat moss.

[2] Redwood shavings may be used for part of the peat in mix E to improve aeration and reduce cost. Redwood shavings or sawdust may also be used for some or all of the peat in other mixes.

TABLE 2.--Chemical ingredients for 1 cubic yard of various U. C.-type soil mixes

Soil mix	Fertilizer	Comments
A---	8 oz. potassium nitrate 4 oz. potassium sulfate 2 1/2 lb. superphosphate 1 1/2 lb. dolomitic limestone 2 1/2 lb. gypsum	Contains moderate amount of available nitrogen but will require supplemental feeding within a short time. Good for rooted cuttings and growing.
B---	6 oz. potassium nitrate 4 oz. potassium sulfate 2 1/2 lb. superphosphate 4 1/2 lb. dolomitic limestone 4 1/4 lb. pulverized limestone 1 1/4 lb. gypsum	Contains moderate amount of available nitrogen but will require supplemental feeding within a short time. Very good for bedding plants and container growing.
C---	4 oz. potassium nitrate 4 oz. potassium sulfate 2 1/2 lb. superphosphate 7 1/2 lb. dolomitic limestone 2 1/2 lb. pulverized limestone	Contains moderate amount of available nitrogen but will require supplemental feeding within a short time. Easily rooted cuttings may be rooted and started in it.
D---	4 oz. potassium nitrate 4 oz. potassium sulfate 2 lb. superphosphate 5 lb. dolomitic limestone 4 lb. pulverized limestone	Contains moderate amount of available nitrogen but will require supplemental feeding within a short time. Good for transplanting and for seed germination.
E---	6 oz. potassium nitrate 1 lb. superphosphate 2 1/2 lb. dolomitic limestone 5 lb. pulverized limestone	Contains moderate amount of available nitrogen but will require supplemental feeding within a short time. Good for potting and bedding mixes.

TABLE 3.--Materials for peat-lite mixes developed by the New York State College of Agriculture[1/]

Materials	Mix A	Mix B (1 cubic yard)	Mix C[2/]	Mix A (2 bushels)
	Bushels	Bushels	Bushels	Bushels
Sphagnum peat moss--	11	11	11	1
Vermiculite, #2-3 or 4	11	--	11	1
Perlite----------	--	11	--	--
	Pounds	Pounds	Pounds	Tablespoons level
Fertilizer, 5-10-5	6	8	--	15
Superphosphate----	2	2	2-1/2	5
Limestone, dolomite	5	5	10	10
	Tablespoons	Tablespoons	Tablespoons	Tablespoons
Borax[3/]---	1	1	1	0
Iron chelate [4/]----	2	2	2	0

[1/] The materials for each medium should be mixed thoroughly. If the peat moss is dry, a small amount of water may be added.

[2/] This mix will need nitrogen and potassium fertilizer as soon as seedlings are planted in it. Perlite may be substituted for vermiculite.

[3/] Eleven percent boron.

[4/] Such as Geigy 138 or 330.

Use medium to fine horticultural-type sphagnum peat moss. Baled peat usually will need to be shredded. Vermiculite, a micaceous material that has been heated to 1,400° F., is sterile and weighs only 6 pounds per cubic foot. It has a relatively high capacity to hold plant nutrients and contains adequate magnesium and potassium for most crops. Perlite is a heated volcanic rock that expands on heating. It is sterile, contains no mineral nutrients, and has a very low capacity to hold plant nutrients.

Peat-lite mixes were developed primarily for growing short-term, spring flowering crops, but they have been successfully used the year around.

Where crops are to be grown longer than 3 months, a complete trace element mix is recommended. In some instances, boron and iron should be added before using. Because the amounts of these are so small, it is not recommended to try to add them to the 2-bushel quantity.

Horticulturists of the University of Georgia and the University of Illinois at Urbana-Champaign found that tree barks may be successfully used for rooting and growing potted plants. The best results at the University of Illinois have been with a mix as given in table 4.

The advantages claimed for the hardwood bark are that it is inexpensive, readily available, lightweight, well aerated and well drained, and has good water-holding capacity. Precautions needed when using hardwood bark are provision for an adequate nitrogen supply, thorough mixing, and watering at the beginning. Because the bark is coarse, careful mixing is necessary to assure an even and thorough distribution of the fertilizer. In addition to the dry fertilizer incorporated with the mix, the horticulturists recommend fertilizing at each watering with a soluble fertilizer of grade 20-20-20 at the rate of 200 parts per million (p.p.m.) of nitrogen in the water. Other fertilizer grades such as 15-30-15, 23-21-17, or 18-18-18 could be used but at a rate of 200 p.p.m. of nitrogen in the water.

Table 4.--Materials for hardwood bark-sand mix developed by the University of Illinois

Materials	1 cubic yard	2 bushels
	Bushels	Bushels
Bark [1/]	15	1-3/4
Sand [2/]	7	1/4
	Pounds	Tablespoons (level)
Fertilizer:		
Osmocote (18-6-12)[3/]	8	15
Gypsum	5	10
Magnesium sulfate[4/]	1	1

[1/] Best results were obtained when particle sizes from 1/16 to 1/4 of an inch were used.

[2/] Fine sand was used.

[3/] MagAmP (7-40-6) may be substituted for Osmocote.

[4/] Epsom salt.

Soil Sterilization

Sterilization of soil with dry heat, steam, or chemicals is necessary to destroy viable weed seeds and undesirable organisms. For dry heat sterilization, bake small lots in shallow pans in the oven at 212° F. for an hour. This method, however, often leads to harmful effects on seed germination and early seedling growth. Also, the partly burned humus often will give off disagreeable odors, especially if the oven temperature rises above 212°. To steam sterilize the potting medium, place it in a shallow pan in a pressure cooker or canner for 1 hour at 5 pounds' pressure. The depth of medium in the pan should be 3 inches or less.

Methyl bromide may be used for chemical sterilization. Place potting medium on one-half of a sheet of plastic, keeping the soil depth to about 12 inches. Then fold the other half of the plastic sheet over the potting medium. If a commercial device is not available for applying the methyl bromide under the plastic, you may construct a suitable can opener. You will need a can that is larger than the methyl bromide can, a piece of board that will fit down into the can, and a large nail. Drive the nail through the board clear to the head; place this into the can with the point of the nail up. Then carefully lower the methyl bromide can into the larger can so that it comes in contact with the nail.

Do not puncture the methyl bromide can yet! Place the can-within-a-can under the plastic cover, and carefully seal cover and bottom by rolling the top and bottom edges over at least six times and fastening in several places with spring-type clothespins to form a gastight bag. Extreme care must be exercised to assure a gastight bag! Then, and only then, open the methyl bromide can by pressing it down on the nail. After exposure, roll back the plastic cover, exposing the soil to the air. When opening the bag, keep on the upwind side.

Use 0.5 to 1.0 pounds actual methyl bromide per cubic yard. Expose to fumigant 24 to 48 hours and aerate 72 hours before seeding or 6 to 10 days before setting plants in treated soil.

COMPOSTS

For the home gardener with limited space, composting is a means of handling bulky organic refuse and at the same time providing a good source of organic matter valuable for soil improvement. The organic matter may be used to improve soil-water relationships, to increase the plant-nutrient-holding capacity of the soil, and to reduce runoff and erosion when used as a mulch. Compost is also a source of slowly available plant nutrients.

Compositing a biological process, and conditions favorable for the activity of micro-organisms are necessary; otherwise, the composting period may be prolonged. Favorable conditions for microbial activity include an adequate and balanced supply of nutrients, air, and water. Ideally, the smaller the particles the more rapid the rate of composting. However, particles that are too small may pack together and exclude air from the interior of the pile. If soft organic materials such as grass clippings are to be composted, it is advisable to add coarse material such as straw, wood chips, or ground corncobs to maintain good physical condition in the pile.

The moisture content should be as high as possible without the pile becoming waterlogged and thereby deficient in oxygen. A moisture content of 60 to 70 percent is usually satisfactory. Individual particles should not glisten as though enveloped in a drop of water. When the material is hand-squeezed, it should be difficult to squeeze out more than a few drops of water. If the pile is too wet, turning it frequently will usually overcome the oxygen-deficiency.

The micro-organisms that are most active in compositing prefer a temperature of 120° to 160° F. This temperature is achieved through the activity of the organisms if the pile is of correct dimensions. However, if the pile is too large, the temperature may go above 160°. The rate of growth and multiplication of the organisms in the pile is dependent on the available supply of nitrogen and other plant nutrients. Organic residues of mature plants such as leaves, grass, straw, bark, sawdust, corncobs, and the like are usually low in nitrogen and phosphorus. These nutrients are usually added as fertilizers to speed decomposition.

Inoculation with special organisms, or additions of enzymes and hormones have not produced beneficial effects on the production of compost. The addition of manure to the compost pile is not objectionable and in some instances provides a means of disposal.

Composting large quantities of materials in a large pile without any supporting or enclosing walls usually leads to the exclusion of air in the pile, with consequent diminution in the rate of composting. Composting studies have shown that the most desirable size for a pile is 6 feet high, 5 to 6 feet wide, and any length. For the home gardener an enclosure may be desirable. A bin can be made of rough boards, or wire. The sides of the bin should be open to provide aeration. The composting site should be well drained.

Before starting the compost pile it is desirable to estimate the quantity of organic material available and to plan the distribution of it so the pile will be about 6 feet high on completion. The pile may be started by spreading a layer of the organic materials about 6 inches deep. Plant nutrients are added to each layer. Building a compost pile is not an exact process and several recipes for plant nutrient additions are published. One of the four combinations as given in the 1957 Yearbook of Agriculture. SOIL, may be used.

Material to Add in Making Compost

Material	Cups per tightly packed bushel
For general purposes, including acid-loving shrubs:	
Combination A:	
Ammonium sulfate	1
Superphosphate (20 percent)	1/2
Epsom salt	1/16
Combination B:	
Mixed fertilizer 10-6-4	1 1/2
or	
Mixed fertilizer 5-10-5	2 1/2
For kitchen garden or flowers not requiring acid soil:	
Combination C:	
Ammonium sulfate	1
Superphosphate (20 percent)	1/2
Ground dolomitic limestone or wood ashes	2/3
Combination D:	
Like B, above, plus ground dolomitic limestone or wood ashes	2/3

A few shovelfuls of garden soil may be sprinkled on each layer to a depth of one-half inch to assure that decay organisms are present. The organic material should be moistened to the extent described above. Successive layers are built up until the pile is about 6 feet high. It is advantageous to build the pile with a depressed top to retain rainfall or water when watered with a hose. During periods of prolonged rainfall it may be necessary to cover the pile to prevent excessive wetting. Composting can be hastened by turning the pile and supplying moisture to parts that may be dry. Frequent turning of the pile is required if a rapid rate of composting is desired. The piles should be turned at least four or five times, at 2- or 3-day intervals beginning on the third day.

It is generally believed that composting will kill many plant disease organisms, insect eggs and larva, and weed seeds. Indeed those pests in the high temperature regions of the pile may be killed by heat. Some pests may be killed by microbial action. However, the outer surface of the pile and the inner regions--especially if anaerobic conditions prevail--usually do not reach temperatures sufficiently high to kill. Therefore, infested materials should be avoided. If infested organic materials are used or the compost is to be used in potting mediums, disinfection is recommended. This may be done by steam, heat, or chemicals as recommended for potting mediums.

The composting process is nearing completion when the temperature begins to decline steadily and does not increase on turning the pile. Finished compost will continue to decompose but at a slower rate than during periods of rapid composting when the temperatures are elevated as described above.

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